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ABSTRACT

Intended as a supplement to the units "Oil: Fuel of the Past" and "Coal: Fuel of the Past, Hope of the Future," this 3-4 day unit contains three activities which briefly explain the chronological development of energy resources and the formation and development of the Organization of Petroleum Exporting Countries (OPEC). The first activity provides students with an actual time line of energy's development and inventions which accompanied that development from 1776-1976. The second activity contains a pre-reading explaining the growing development of fossil fuels in American technology. The final activity explains the events leading up to and following the oil embargo crisis of 1973-1974. Rationale, objectives, and instructional strategies are provided for each activity. A list of process skills fostered in the unit, Fry readability ratings for two readings (11th year), advanced teacher preparation, goals, and evaluation suggestions are provided in the introduction. (Author/JN)

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HISTORY OF UNITED STATES ENERGY

Adapted and Edited by

Hugh McDermott
Larry Scharmann

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Ruth Hahn

A BASIC TEACHING UNIT ON ENERGY

SE039-16

TO THE INSTRUCTOR . . . .

"The History of U.S. Energy" is intended as a supplement to the units "Oil: Fuel of the Past", and "Coal: Fuel of the Past, Hope of the Future." This unit contains three activities which attempt to explain briefly the chronological development of energy resources
and the formation and development of the Organization Of Petroleum Exporting Countries (OPEC).

Energy Info - A Directory of Publications and Audio-Visual Materials From the Nebraska Energy Office, contains a list of general topics available from the Nebraska Energy Office. You are encouraged to use the ordering page attached to this unit to order additional materials.

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ACKNOWLEDGEMENTS

The original "Basic Teaching Units on Energy" consisted of a package of 30 instructional packets contained within three volumes. The original fourteen units were written at the University of Nebraska-Lincoln, under the auspices of the Nebraska Energy Office, by Nebraska teachers participating in a three-week Faculty Development Institute sponsored by the U.S. Department of Energy (summer, 1978). The units were edited by the following individuals:

-Dr. Donald McCurdy, Professor of Science Education, University of Nebraska-Lincoln;
-Mr. Gary A. Lay, Education Coordinator, Nebraska Energy Office; and
-Dr. Robert Reeder, Science Department Chairman, East High School, Lincoln, Nebraska.

An additional eight units were written by independent authors in the summer of 1979 and the final eight units were developed as a result of a second federal grant (summer, 1980).

The present format has been achieved as a result of an evaluation conducted by the Nebraska Energy Office, February, 1981. Rather than continue to offer all 30 units as a single package, the Nebraska Energy Office determined to revise, edit, and typeset the 10-12 highest quality units and continue to offer the other units in their present format.

The editors of these revised "Basic Teaching Units" wish to thank the individual writers, original editors, and clerical staff for their contributions in creating the "Basic Teaching Units".

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THE HISTORY OF UNITED STATES ENERGY

Abstract

Activity #1 "Finish the Energy Timeline" provides students with an actual timeline of energy's development and inventions which accompanied that development from 1776-1976. The second activity "Fossil Fuels and American Civilization" contains a pre-reading activity explaining the growing development of fossil fuels in American technology. The final activity "The Turning Point" explains the events leading up to and following the oil embargo crisis of 1973-1974.

Recommended Level

Grades 7-10

Academic Areas

Social Studies

Readability Rating (Fry)

The readability rating level given for each reading below is based on the number of syllables per hundred words and number of sentences per passage. These reading level estimations will allow teachers the opportunity to perform some prereading exercises on vocabulary and concept development.

"Fossil Fuels and American Civilization" - 11th Year

"The Turning Point" - 11th Year

Time Required

3-4 days

Process Skills

-discussing
-identifying
-reading
-researching

Advanced Teacher Preparation

Obtain: Any films or cassettes applicable.

Read: Energy Info - A Directory of Publications and Audio Visual Materials from the Nebraska Energy Office.

Goals

1. Students will gain an understanding of fuel sources used from 1776 to 1976.
2. Students will become aware of the relationship between technology and energy sources.
3. Students will be able to gain an understanding of the formation of OPEC and its effects on the oil industry.

Student Objectives:

These are included before each activity.

Evaluation Suggestions

This unit allows teachers to develop their own instruments for evaluation.

Instructor Information . . .

Finish the Energy Timeline

Rationale: Changes in lifestyle, the growth in population, and the demand for goods and services are continuing factors of our growing energy dilemma. This unit will help students to see that humans have always been problem-solvers and that human inventiveness can help us continue the progress we began in this country 200 years ago.

Objectives: Students will perform simple research to complete statements on a timeline covering 200 years of energy development.

Implementation: Each activity sheet includes four 25-year segments, which can later be cut apart and joined into one long timeline. By gathering facts from encyclopedias and other classroom references to complete the statements, students will quickly gain a historical framework from which to move into the concerns of the present day.

Debriefing: After students have completed their timelines, ask them to examine them and find the following information:

- -the invention that makes it possible to start a car
- -a famous example of hydroelectric power (Hoover Dam or Niagara Falls)
- -two kinds of energy that promise great hope for the future (nuclear and solar)

Name _____

Date _____

CUT

1776

In England James Watt puts two engines to work in factories and starts an energy revolution. The energy is steam.

1783

Two men fly in a balloon at Paris, France. The energy used is hot air.

Most people burn wood for heating heating and cooking and travel by horse or on foot.

1880

In Italy, Volta invents the battery and gives his name to the volt. The energy produced is electricity.

CUT

1804

An Englishman, Richard Trevithick, puts James Watt's engine on wheels and rails. He is the father of the railroad locomotive.

1807

Robert Fulton doesn't build the very first steamboat, but he makes the one people first pay to ride on.

Wood continues to supply most household energy needs. But coal begins to do more in factories and railroad engines.

1821

First attempt to develop and market natural gas near Fredonia, N.Y.

CUT

1829

An American names Joseph Henry, and an Englishman named Michael Faraday each invents a generator. Who is first? Henry. The energy produced? Electricity.

1837

Americans put new inventions to work. First comes McCormick's reaper, then the steam shovel by Otis, and the telegraph by Morse.

Railroads expand rapidly, hauling freight and passengers brave enough to stand the jolts and to risk hot cinders that often fly from the engine into their cars. England is first and America second in railroad locomotive production.

CUT

1859

Edwin Drake strikes oil in Pennsylvania beginning the petroleum industry.

1860

Lenoir of France invents the internal combustion engine.

An explosion inside a cylinder paves the way for the later invention of the automobile. An oil strike hastens the discovery of the fuel that will run it.

CUT

Name _____

Date _____

CUT

Coal and wood still furnish most of the energy in homes. "Iron horses" and real ones continue to take most people places.

1884

In England, Charles Parsons perfects the steam turbine and advances the development of electrical energy.

1886

Karl Benz builds the first successful automobile.

1892

The oil-burning engine is invented by Rudolph Diesel. Eventually, this engine will replace steam-powered ones.

CUT

1895

The power of Niagara Falls is harnessed to make electricity.

1903

The engine in the Wright brothers' plane is powered by gasoline.

1905

Albert Einstein develops a theory for measuring energy and prepares the way for the atomic age.

1910

Ford makes the first Model T car.

CUT

By the end of this period, many new homes have coal furnaces in the basement. And more and more cars appear in garages.

1926

Robert Goddard tests a rocket.

1936

Hoover Dam on the Colorado River is built to generated hydroelectric power.

1940

Nylon, a fiber made from oil, coal and water makes its first public appearance.

CUT

1942

In Chicago, Enrico Fermi sets off the nuclear chain reaction.

Many homes convert from coal to natural gas for heating. Most families own at least one car and some have two.

1952

Bell Scientists raise hope for our energy future with the solar battery.

1957

The U.S. gets its first big nuclear power plant at Shippingport, Pa.

CUT

Demands for energy grow. America gets more people, more homes, more factories and businesses, more cars, more trucks, more buses, more planes. Demand grows faster than supply.

1970

Congress passes the Clean Air Act.

1973

OPEC nations embargo oil and produce an energy crisis.

1976

Americans continue to look for ways to conserve the energy we have and find new energy sources.

CUT

Fossil Fuels and American Civilization

Rationale: As American Civilization spread across the continent, there was a need for transportable sources of energy. With the development of machines and equipment, the development of energy sources began and the initiation of fossil fuels took place. The United States continues to rely heavily on fossil fuels for many reasons. This dependence may eventually cause severe economic problems.

Objectives: Students will be able to complete the vocabulary activity before reading the article "Fossil Fuels and American Civilization."

Students will be able to read and discuss "Fossil Fuels and American Civilization."

Implementation: Hand out student worksheets which contain vocabulary words students should become familiar with, as they will appear in the reading. Students may need dictionaries for assistance or they may read the article, then complete the vocabulary activity.

Debriefing: After reading the article, have students discuss the advantages and disadvantages of using fossil fuels.

The History of U.S. Energy
Activity # 2
Student Worksheet

Name _____

Date _____

Directions: Place the letter of the correct definition in the blank for the correct vocabulary term.

1. _____ crucible	A.	unwillingness
2. _____ exploitation	B.	the act of using up
3. _____ condensed	C.	a small lamp, light
4. _____ ubiquitous	D.	abundance of wealth
5. _____ reluctance	E.	the improper use of something
6. _____ consumption	F.	compressed, made more compact
7. _____ affluence	G.	appearing everywhere or in many places throughout a particular area
8. _____ barrage	H.	a timely and gratuitous benefit
9. _____ boon	I.	a massive flow or continuous discharge
10. _____ depleted	J.	used up, emptied.

The History of U.S. Energy
Activity # 2
Answer sheet

Name _____

Date _____

Directions: Place the letter of the correct definition in the blank for the correct oacabulary term.

1.	C	crucible	A. unwillingness
2.	E	exploitation	B. the act of using up
3.	F	condensed	C. a small lamp, light
4.	G	ubiquitous	D. abundance of wealth
5.	A	reluctance	E. the improper use of something
6.	B	consumption	F. compressed, made more compact
7.	D	affluence	G. appearing everywhere or in many places throughout a particular area
8.	I	barrage	H. a timely and gratuitous benefit
9.	H	boon	I. a massive flow or continuous discharge
10.	J	depleted	J. used up, emptied.

Name _____

Date _____

in the beginning

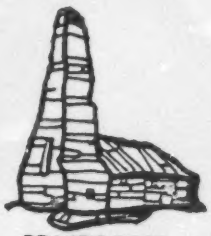
Europe was the cradle of the Industrial Revolution, but it was America that served--and continues to serve--as the crucible of the technological age. The history of the United States appears to us today as a migratory history. From the origins of the Republic, the population surged westward into the interior, leaving behind a network of trails, post roads, railroads, towns, and farms. From the beginnings, the pioneers were preoccupied with speed--getting across the country as quickly as possible . . .

Fossil Fuels and American Civilization, 1850-1900

transportable sources of energy

The backbone of high energy civilization is the availability of concentrated, readily transportable sources of energy. The energy-intensive lifestyle characteristic of the Western industrialized world today was born with the first oil well and the sudden exploitation of coal about the time of the Civil War.

America sets the pace



DRAKE'S FIRST OIL WELL

America has set the pace for the lifestyle of the high energy civilization. It was here that oil was first drilled and exploited on a large scale. It was here that coal and steam condensed a continent into a few days train journey. It was here that the electric light and the electric destribution system were invented. It was here that abundant energy and mass production made the cheap automobile ubiquitous. It was here that the potent fire of the atomic nucleus was harnessed to produce still more energy and destruction.

And it is here that the inevitable collision between unlimited energy demands and limited energy resources was first occurring.

the fossil fuel energy society

The second half of the nineteenth century was marked by the emergence of the fossil fuel energy society in America. Up to this time, the young nation had been running largely on muscle power and renewable resources--wind, falling water, and firewood. In 1850, about two thirds of all horsepower-hours produced came from the work of animals--about half of that from horses and one eighth from human beings. Two thirds of all mechanical work in terms of horsepower was done by windmills and falling water. . .

the growing demand for coal

King Coal

There was a reluctance in most parts of the United States to utilize coal. It was the extensive cutting of the forests, which raised the price of wood in the East and increased the distance to which it had to be carried to the growing cities, that the demand for coal began to rise. Its consumption tripled between 1850 and the beginning of the Civil War in 1861. Demand for it continued to grow rapidly with its increasing replacement of wood as the fuel for steam locomotives and for manufacturing--especially the fast growing iron and steel industry. In 1885 coal surpassed wood as the dominant fuel and launched the United States into the fossil fuel economy, whose cheap and abundant energy was to propel the nation to affluence and the world crisis. In the first year of the American fossil fuels era, 40 percent of the coal went to fuel the railroads and 13 percent went to coke production for the steel industry. The remaining 47 percent went to other miscellaneous industries and to homes for residential fuel. The use of coal continued

to grow, and its share of the nation's fuels had spiraled from 9 percent in 1850 to 65 perenet in 1895. Coal was now King, and it was to remain the dominant fuel well into the twentieth century.

"coal oil" or "kerosene"

Oil entered the American economy on a large scale in 1860, when five hundred thousand barrels of crude oil were produced. The nation had long been searching for a good cheap fuel for lamps and lanterns. A coal product was being received more enthusiastically. An English coal mine operator in Derbyshire had devised a method of producing oil from coal, which he called coal "oil" or "kerosene".

crude oil becomes important

The popularity of the new lamp fuel rose rapidly. From 500,000 gallons in 1860, the year the first oil well came in, crude oil production rose to 1.7 million gallons five years later, and to more than 2 million gallons by 1870--most of it kerosene. By 1880, crude oil accounted for 13.2 percent of all mineral fuels consumed, a level that it maintained well into the first decade of the twentieth century. As late as 1900, kerosene still accounted for two out of every three gallons that left the refinery.

inventions stir on the use of energy

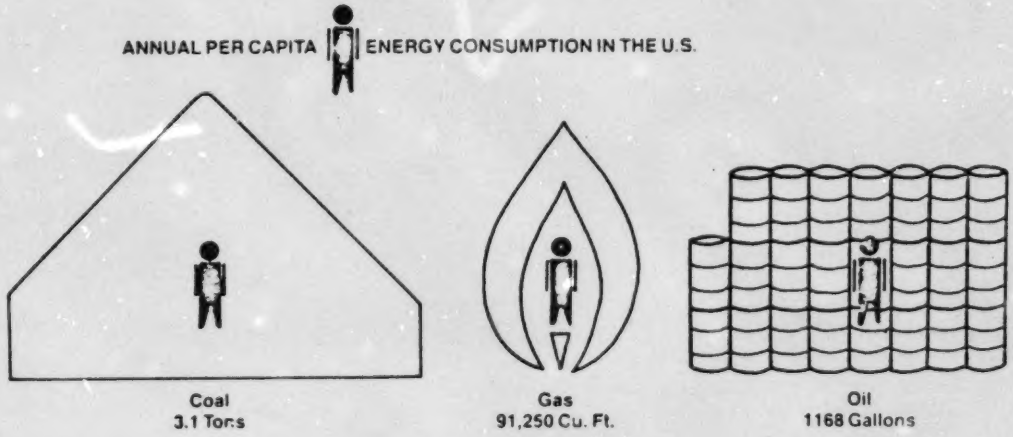
With the growing awareness of the ready availability of concentrated fossil fuels came a bewildering barrage of machines and technologies designed to capitalize on them. Many of them proved to be milestones of modern civilization: the automobile, for example; and the telephone, patented by Alexander Graham Bell in 1876. Of perhaps even greater significance were the electric light in 1879 and the subsequent creation of a distribution system to permit its common use.

technology brings energy to us

The electric light and the electric power distribution system required to sustain it were to change the world as have no other technological developments. Electricity made it possible to deliver the work potential generated by the steam engine to distant sites cheaply and without the noise, smoke, size, or other characteristics of the steam engine at the generating site. In effect, it put the steam engine, with all its enormous capability, at the disposal of virtually every home, business, and industry in America and much of the Western world.

fossil fuels--a boon and a curse

It has become apparent the development of fossil fuels has been a boon to humanity--but a curse as well. All the wonders of today's technology are based on the fossil fuel energies, but the sophisticated technology of high energy American society has failed to develop a source of energy to fuel itself when the fossil fuels are depleted.



The Turning Point

Rationale: The formation of OPEC (Organization of Petroleum Exporting Countries) is now approximately 22 years old. This organization was formed in an attempt to seek a united front among themselves for dealing with oil price increases. This particular reading gives background information concerning the formation of this organization, attempts to break it, and "control" aspects of oil.

Objectives: Students will be able to read "The Turning Point".

Students will be able to discuss OPEC's role in the development of oil policy and its effect on developed and undeveloped countries.

Implementation: Hand out "The Turning Point" and read.

Debriefing: It may be necessary to locate additional factual information concerning OPEC developments.

Name _____

Date _____

The Turning Point

the "Seven Sisters"

world market agreement

For more than 50 years the world's oil trade has to a large extent been managed by seven major companies--the "Seven Sisters," as they are often called--five of which are American.[1] All of them are "integrated," meaning that they are equipped to do everything in the oil business: produce, refine, transport, and market.

According to some scholars, the essential pattern of the Sisters' international operations was set once and for all in 1928, when industry leaders gathered at Achnacarry Castle in the Highlands of Scotland.[2] The result was a secret agreement which began by noting that "excessive competition" had resulted in "tremendous over-production."[3]

[1] Their present names: Exxon, Gulf, Mobil, So-Cal (or Chevron), Texaco, Shell, and BP (British Petroleum). Shell is under Dutch-British management; BP is half-owned by the British Government

[2] Anthony Sampson, The Seven Sisters, Viking Press, New York, 1975, p. 72.

[3] Ibid., p. 73

To avoid such situations in the future, the agreement provided for dividing world markets and stabilizing prices.[4]

working together

The general concept of this agreement seemed consistent, moreover, with another important aspect of the relationship among the Sisters: their working together in common enterprises.

meeting supply and demand

Managing international oil production so as to provide a stable growth in supply, as world demand increased, while avoiding any overproduction with attendant falling prices, was a complex undertaking. Among other things, it meant that the production rates of many desparate countries had to be brought into overall harmony--a delicate process sometimes requiring that certain countries be used as "eveners," i.e., that their production rates be reduced.

the formation of OPEC

On the whole, from the end of World War II until the mid-1960's, "the international and omestic market control mechanisms of the oil industry achieved their objectives with exemplary precision."[5] However, in 1959 and

[4] John M. Blair, The Control of Oil, Pantheon Books, New York, 1976, p. 62.

[5] Ibid., p. 207

1960 the majors were obliged to lower oil prices somewhat, because of competition from medium-sized "independent" companies. In reaction, the producing countries--largely at the initiative of Venezuela--banded together and formed the Organization of Petroleum Exporting Countries (OPEC), in an effort to prevent future declines in price.

independent competition

Then, in the mid-1960's, a wave of competition began to be felt from some independents which had managed to win concessions, alongside the majors, in Libya. The independents were selling their product on world markets at lower prices; and the majors were threatened with "the painful necessity of offsetting the Libyan expansion with corresponding reductions in the Middle East, thereby imperiling their invaluable concessions in that area."[6]

the beginning of production cutbacks

Help came from an unlikely quarter: the revolutionary government of Colonel Qadhafi, which in 1970, soon after coming to power, asked the independents for a price increase--of

[6] Ibid.

40¢ per barrel. When this was refused, the Qadhafi government imposed cutbacks on oil production in Libya.

OPEC COUNTRIES
Algeria, Ecuador, Gabon, Kuwait, Libya, Nigeria, United Arab Emirates, Indonesia, Iran, Iraq, Qatar, Saudi Arabia, and Venezuela

Libya finally did win a concession, however--a price increase of 30¢. Though the amount was not large, the oil companies feared that it could be a precedent for competing demands between Libya on the one hand and the Middle East countries on the other. To avoid being thus whipsawed, they sought to form a united front among themselves for dealing with OPEC as a whole. But over the next few years OPEC demands were to escalate from price increases to "gradual nationalisation, under the tactful slogan of 'participation'"; and the united front did not hold.[7]

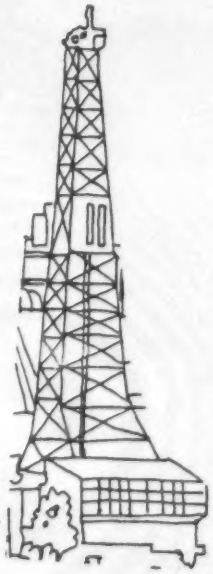
the 1973-'74 oil embargo

When war again broke out in the Middle East in the fall of 1973, the Arab oil-producers imposed an embargo on the United States in protest against a U.S. military airlift and some $2 billion in economic assistance to Israel. Other OPEC members did not take part in the embargo, but in the end they nevertheless benefited from this period of shortages and

[7] Sampson, Sisters, p. 230

uncertainty. By this time the embargo was lifted in March 1974, the world price of oil had quadrupled. And decisions about production and pricing which formerly had been made by the companies were now being made by the producing countries.

oil companies: a tarnished image



Meanwhile, the major oil companies had the task of applying the embargo; and in the United States opinion polls showed that "Americans blamed the companies more than the Arabs."[8] Although U.S. imports of Arab oil were almost completely cut off before the embargo ended, many Americans felt the shortage within the country was more contrived than real; and there were cries of "rip-off" when gasoline became abundant again after an increase of 40% in price. In the meantime, moreover, the major oil companies had further tarnished their public image by announcing unprecedented profits for the preceding year--due mainly to the greatly enhanced value of their inventories (although those would have to be replaced at higher prices).

[8] Ibid., p. 266

suspicious favoritism

In Europe also the major oil companies ran into stormy weather, though of a somewhat different kind. Since most of them are American-based, there was suspicion that during the embargo they had shown favoritism toward the United States. A European Commission report subsequently absolved them of this charge, however, and exoneration came also from the prestigious European, North American, and Japanese Trilateral Commission.[9] This latter body said the companies "did well in the distribution of available supplies," adding that they had not sought this onerous responsibility "and do not want it in the future."[10] [Since then the International Energy Agency (IEA) has in fact drawn up a plan which would assign this function to governments in any future emergency.]

9 The Trilateral Commission was formed in 1973 by private citizens "to foster closer cooperation among these three regions on common problems." Ambassador Gerard C. Smith (former U.S. SALT negotiator) was named North American chairman.

10 "Energy: The Imperative for a Trilateral Approach," Triangle Paper No. 5, 1974.

skepticism of an energy problem

The general feelings of doubt and suspicion engendered at the time of the embargo have nevertheless persisted, at least to some degree--and not only in the United States. A report issued by the OECD in the latter part of 1976, for example--following a study of energy conservation efforts in 17 of its member countries--noted that in most of these countries people were "skeptical that any energy problem exists." "It remains to be seen," the report concluded, how effective government conservation policies and programs could be "in such an environment."[11]

OPEC attitudes

With respect to OPEC attitudes toward the companies in the wake of all these turbulent events, a book published by an OPEC official in the latter part of 1974 reflects a mixture of sentiments. On the one hand, the author takes them strongly to task for their historical role, and applauds the progressive nationalizations that were taking place. But on the other hand, the book states that the producing countries "must be aware that the share which they are getting out of their oil could not possibly be

[11] Energy Conservation in the International Energy Agency--1976 Review, OECD, Paris, 1976, p. 8.

attained without the capital, the technique, and the experience of the companies."[12]

Electricity Production by Primary Energy Sources (Approximate percent)

Year	Hydro	Fuels			Nuclear	Power Generated (Billion kWh)
		Coal*	Oil	Gas		
1922	39	53	6	2	—	61
1932	41	48	3	8	—	99
1942	34	55	3	8	—	186
1952	26	49	8	17	—	514
1962	20	53	5	21.7	0.3	944
1972	16	44	16	21	3.0	1,853
1980	12	48	14	15	11.0	2,250

*Coal includes negligible amounts of geothermal, wood, and waste used to generate electricity.

12 Abdul Amir Q. Kubbah (Acting Chief of OPEC's Information Department), OPEC Past and Present, Petro-Economic Research Centre, Vienna, 1974, pp. 7, 101, and 131.

SUPPLEMENT

Pamphlets

Energy Info - A Directory of Publications and Audiovisual Materials From the Nebraska Energy Office.

The United States and World Energy, Ralph Stuart Smith, Special Adviser, Bureau of Public Affairs, November, 1977.

Ditto Book

Energy Challenge, Department of Energy.

Teacher Resources for Energy Economics, American Petroleum Institute, Washington, D.C.

Book

Energy for Survival: The Alternative to Extinction, Wilson Clark, Anchor Books/Doubleday, 1974.

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